Does Strict Employment Protection Legislation Influence the Rate of Workplace Accidents?

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ABSTRACT

This paper explores the correlation between employment protection legislation (EPL) and the rate of workplace accidents, using a theoretical model and data for OECD countries. EPL has been rolled back in most OECD countries since the mid-80s. In parallel, there has been a decrease in the number of workplace accidents reported, especially non-fatal ones. We ask the question whether less employment protection could have contributed to the reduction in accident rates, for example by reducing workers' willingness to report accidents. To investigate, we build a theoretical model, which suggests that the incentives to report workplace accidents are complex and could even result in a negative relationship between EPL and accident reporting. It is possible for example that labour market reforms reduce job security and incentivise behaviours that bring immediate benefits, like accident reporting. The empirical analysis, using a database of 16 OECD countries, supports the view that the dilution of EPL for regular contracts has increased the rate of accident reporting. This result is robust after controlling for a number of other factors, such as the unemployment rate, economic growth, unemployment benefits, trade union density and temporary work.

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1 INTRODUCTION

A lot of attention has been devoted to finding out what causes accidents, both fatal and non-fatal, at work. Amongst economists, this was first investigated by Kossoris (1938), who found that the number of workplace accidents varied pro-cyclically. This led to a number of studies that looked at this issue using data on individual firms and workers (Schuster and Rhodes 1985; Ruhm 2000; Boone, van Ours, Wuellrich and Zweimüller 2011), industry data (Curington 1986; Arai and Thoursie 2005; Asfaw, Pana-Cryan and Rosa 2011), aggregate data for a country or territory (Wooden 1989; Mouza and Targoutzides 2012), and cross-national data (Boone and van Ours 2006).

There is also a growing literature on the effects of employment protection legislation (EPL). Studies have focused on such things as its effects on the rate and structure of unemployment (Nickell 1997; Nickell, Nunziata and Ochel 2005; Sarkar 2013), self-employment and entrepreneurship (Robson 2003; Torrini 2005; Baumann and Brändle 2012), productivity (Nickell and Layard 1999; Bassanini, Nunziata and Venn 2009; Autor, Kerr and Kugler 2007), investment - both foreign (Görg 2005; Javorcik and Spatareanu 2005; Radulescu and Robson 2008; Wood, Yin, Mazouz and Cheah 2016) and domestic (Alesina, Ardagna, Nicoletti and Schiantarelli 2005; Radulescu and Robson 2013) – and absenteeism (Ichino and Riphahn 2005; Frick and Malo 2008).

In this paper, we focus on the effect of EPL on the rate of workplace accidents, an aspect neglected so far. A series of labour market reforms in OECD countries has reduced the level of employment protection in the past 30 years. At the same time a downward trend in the rate of workplace accidents is observed in these countries. We investigate whether there is a correlation between these trends; for example with lower employment protection workers may be afraid to report accidents for fear of losing their job.

Table 1 shows the number and incidence of workplace accidents in 1990 and 2011. There are substantial differences between countries, with Portugal showing the highest incidence of accidents in the workplace, followed closely by Spain - at least as far as the number of non-fatal accidents is concerned.[1] The United Kingdom, Greece and Ireland on the other hand are the 'safest' places to work. The main thing that stands out is that over the twenty-one years shown here there has been a substantial decrease in accidents at work in almost all of the countries for which we have data, most notably in the case of non-fatal accidents.

Table 1 about here

[1] The Netherlands seems to be something of an outlier here in terms of the rate of non-fatal accidents. This is due to a change in the source for these figures from insurance records before 1989 to the Working Conditions Survey for more recent figures from 2010 onwards. In the empirical work included in this study we control for this by using a dummy variable to denote a structural shift in the way that these figures are calculated. See the Appendix for more details of these structural breaks.

A look at the recent history of EPL using data compiled by the OECD suggests that over the period from 1985 to 2013 there is also a decrease in the level of employment protection legislation in most of the countries studied (see Figure 1). The OECD indicator is scaled to lie between a minimum value of 0, corresponding to very weak EPL, and a maximum of 6, corresponding to very strict employment protection. The indicator refers to the rules affecting regular (permanent) workers dismissed on personal grounds or economic redundancy but without fault. The data illustrated in Figure 1 indicate that the overall strictness of EPL tends to be highest in the southern European countries – Portugal, Italy and Spain – and weakest in the USA, Canada and the United Kingdom. A number of countries – Portugal, Spain and Greece among them – introduced measures to relax the strictness of EPL in their economies between 1985 and 2013.

Figure 1 about here

The index of employment protection legislation has three distinct components – i.e. the procedural inconveniences that employers face when starting the dismissal process, such as notification procedures and delay before notice can start (*EPL1*); the length of the notice period and the amount of severance pay to those dismissed (*EPL2*); and finally the difficulty of dismissal as determined by the circumstances in which it is possible to dismiss workers, as well as the repercussions for the employer if a dismissal is found to be unfair, such as compensation and reinstatement (*EPL3*).[2] Figure 2 shows the cross-country averages for the components of employment protection, suggesting that these reforms span all of the three components.

Figure 2 about here

In most countries legislation prohibits firing a worker for reporting workplace injuries. Even in the US, the country with the least employment protection in Figure 1 the Occupational Health and Safety Act of 1970 protects workers against any sort of retaliation (including dismissal) for exercising their rights with regards to health and safety at work.[3] In the UK, another country with relatively relaxed employment protection laws the main piece of legislation is the Employment Rights Act, passed in 1996, which lists dismissal related to health and safety among the unfair reasons for dismissal. [4]

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[2] See the Appendix for more details of what is included in these measures of *EPL*.

[3] The International Labour Organisation (ILO) provides an overview of legislation in various countries.

[4] The Employment Rights Act in fact formally codified already existing laws passed in the 60s, 70s and 80s so it did not lead to a big jump in the employment protection index represented in Figure 1.

Many European countries with high levels of employment protection have attempted to reform their labour markets to allow more flexibility. The drivers of reform have been the competitive pressures created by the Single Market in the early 90s and the pressures of the single currency, especially after the financial crisis that enveloped the euro area in 2009. Between November 2011 and October 2013, Portugal, which experienced the largest reductions in employment protection, has significantly reduced the amount of entitlement to severance pay for new hires (while largely preserving the accumulated rights of existing workers). In addition, Portugal has attempted to ease the definition of fair dismissal through the introduction of a new reason for dismissal – inadaptability with change to the nature of a job - and it has introduced performance-related criteria for dismissing workers in the case of the extinction of a work position. As a result of these reforms the stringency of EPL is now closer to the OECD average (see OECD, 2017, for further details).

The relaxation of regulation for regular contracts was accompanied in many countries by an increase in permissiveness of temporary work, which resulted in an increase in the share of temporary workers. The reform of regulation regarding temporary contracts has affected both standard and agency contracts but it is in the area of agency work that the reforms have been at their deepest. During the 1980s most countries allowed agency work only in specific industries and in some countries work agencies were illegal (Belgium, Greece, Italy and Sweden stand out in this respect). Reforms started in most countries by the mid-1990s, preceding the European directive of 1999 that extended the rights of permanent workers to standard temporary workers, but not agency workers. By 2011 agency work was allowed in all countries and within countries in most industries. The rules regarding the maximum period allowed for agency contracts has lengthened in most countries although there are still restrictions to the number of such contracts that can be offered. These regulatory changes are reflected in an increase in the share of temporary workers from 9% in 1985 to 12% in 2011 (based on OECD data).

The OECD quantifies the restrictions on the use of fixed term or agency work and the cumulative duration / number of such contracts that are allowed on a scale from 1 (few restrictions on the use of temporary contracts) to 6 (temporary contracts can only be used in certain situations). Figure 3 shows the evolution of this variable over time and indicates a general tendency towards loosening the restrictions around the use of temporary work. In addition, Figure 3 plots the share of temporary workers, available from the OECD Employment Database. Clearly the effect of the removal of restrictions on temporary contracts is accompanied by an increase in the share of temporary workers.

Figure 3 about here.

To analyse the effect of employment protection on accident reporting we first introduce incentives in a theoretical model based on efficiency wages. While conventional wisdom would suggest that workers whose jobs are not protected are

afraid of reporting accidents for fear of losing their job the model shows that the relationship is more complex. In an efficiency wages framework incentives could work in the opposite direction – a reduction in employment protection, by reducing the expected value of a job, may incentivise workers to report accidents. We then use a cross-country panel dataset of 16 OECD countries to test the relationship between EPL and workplace accidents. Our hypothesis is that EPL has an effect on workers' incentives to report an accident rather than the true rate of accidents. If this is the case, then the effect should be evident in the case of non-fatal accidents but should be absent from fatal accidents, whose reporting is not subject to incentives. We control for unemployment, GDP growth, the replacement ratio and trade union density, and consider the role of temporary contracts.

2 DOES EMPLOYMENT PROTECTION LEGISLATION MATTER FOR WORKPLACE INJURIES? A MODEL OF INCENTIVES

A worker who suffers a minor workplace injury can decide whether to report the accident or not. In cases in which the employer could easily dismiss a worker who is prone to accidents in the workplace, it is more likely that the employee would refrain from reporting the accident. This is supported by the OECD (1989), who note amongst the social and psychological factors that influence workplace accident statistics that "workers may not report injuries because they fear loss of attendance bonuses, or other personal disadvantages, such as becoming prime candidates for redundancy". This suggests that the relationship between the rate of non-fatal workplace accidents and the strictness of EPL depends on incentives.

In what follows, the relationship between EPL and accident reporting is captured by a model based on the efficiency wage framework, in which the reporting of accidents depends on the wage level.[5] A high wage makes it costly for workers to claim compensation for accidents if this action makes it more likely that they will lose their job. Also high wages may be perceived by workers as a 'gift' and reduce their willingness to impose costs on the firm.[6] We focus on the role of incentives by keeping the true rate of accidents constant.

2.1 THE RESERVATION WAGE

It is assumed that workers have an incentive to report accidents because every time they do so they receive some compensation from the firm. This compensation, denoted by c, must be interpreted in a broad sense, as a cost to the firm. Companies are generally insured against the risk of accidents but frequent compensation payments lead to higher insurance premiums. Also not all accidents attract financial compensation. Some accidents result only in sickness leave, which generates a benefit to the worker in the form of extra leisure but also a cost to the

[5] The standard efficiency wage framework (see the seminal paper of Shapiro and Stiglitz 1984, among others) has been used to analyse sickness leave by Barmby, Sessions and Treble (1994).

[6] These arguments are also used in the efficiency wage literature to justify the link between wages and effort (see Carmichael 1990, for a discussion).

firm in terms of lost output. Finally the incentive to report might be the desire to have the cause of the accident removed by the firm, in which case the compensation is in the form of a reduction in the probability of having an accident in the future. In effect c represents the general benefit to the worker of reporting an accident and can take several forms, all of which are costly to the firm.

Workers face an exogenous rate of separation, δ, which is higher if they report an accident. Accidents happen with probability λ and if they are reported the worker receives compensation c, but faces a higher separation rate, δ_A, with $\delta_A > \delta$. In what follows, the probability of having an accident, λ, is kept constant but the willingness to report may vary. We consider here only minor accidents so that workers have a choice of whether to report them or not. They choose to report the accident if the compensation they receive is higher than the cost. For a worker, the asset value of being employed can be written as

$$rW = w + \lambda max[c + (W_A - W), 0] + \delta(U - W), \quad (1)$$

where r is the discount rate, w is the wage, c is the compensation, W_A is the value of being employed after reporting the first accident and U is the value of being unemployed. After reporting an accident the worker receives compensation but faces a higher separation rate. This higher separation rate remains high for as long as the worker is employed, so any accidents that happen subsequently are reported – there is no gain from refraining to do so. The value of being employed becomes

$$rW_A = w + \lambda c + \delta_A(U - W_A). \quad (2)$$

If the workers lose their job they receive unemployment benefits and their accident reporting record is erased. While a worker searches for a new job, the value of being unemployed is

$$rU = b + q(\theta)(W - U), \quad (3)$$

where b is the unemployment benefit net of search costs, $q(\theta)$ is the probability of finding a job if unemployed and θ is market tightness, i.e. the ratio of the number of vacancies to the number of unemployed, with $q'(\theta) > 0$. The Beveridge curve links the vacancy rate (v) to the unemployment rate (u), with $v'(u) < 0$, as a higher vacancy rate is usually associated with lower unemployment. This implies $q(\theta) = q(v(u)/u)$ where $\partial q/\partial u < 0$.

The reservation wage, which makes the worker indifferent between reporting and not reporting an accident is obtained by setting $W - W_A = c$. With $W - W_A$ resulting from equations (1), (2) and (3) the reservation wage is

$$\bar{w} = b + \frac{c}{\delta_A - \delta}(r + \delta + q(\theta))(r + \delta_A + \lambda), \text{ where } \frac{\partial \bar{w}}{\partial \theta} = \frac{c}{\delta_A - \delta}(r + \delta_A + \lambda)q'(\theta) > 0. \quad (4)$$

We assume that EPL influences the rate of job separation by imposing firing costs on employers. We follow Boeri and van Ours (2008, p223-224) in modelling this firing cost as a deadweight loss to the employer, so that $\delta = \delta_0 - \delta_1 c_f$ and $\delta_A = \delta_{A0} - \delta_{A1} c_{Af}$ where c_f and c_{Af} are the costs of firing non-reporting and reporting workers respectively, and $\delta_0, \delta_1, \delta_{A0}$ and δ_{A1} are positive constants. For simplicity we assume that $\delta_1 = \delta_{A1}$. Depending on the type of legislation, employment protection may

change c_f, c_{Af}, or both. The firm prioritises workers who report accidents for redundancy, but also workers who are prone to accidents may be more likely to leave their jobs. In any case, we assume that $\delta_{A0} > \delta_0$, so even when the cost of firing is the same, a worker who reports accidents has a higher rate of job separation compared to a worker who does not.

If workers are identical the rate of accident reporting is either zero (if wages are above the reservation wage) or λ (if wages are below the reservation wage). A fall in δ_A alone (for example due to the introduction of legislation specifically prohibiting unfair dismissal following an injury sustained in the workplace, which has the effect of increasing c_{Af}) can be shown to increase the reservation wage ($\frac{\partial \bar{w}}{\partial \delta_A} < 0$), which may increase accident reporting. By reducing the probability of becoming unemployed as a result of accident reporting, such a piece of legislation has the straight-forward effect of encouraging workers to report accidents.

On the other hand, legal restrictions like those included in the Employment Rights Act (1996) in the UK protect workers against unfair dismissal and lower the probability of job separation for all workers, including accident prone ones, decreasing both δ and δ_A. Such a law would increase both c_f and c_{Af} leaving the gap between δ_A and δ constant, in which case it is easy to see from (4) that this type of wide-ranging legislation reduces the reservation wage, making it less likely that accidents get reported.[7] The reduction in the job separation rate increases the value of being employed with or without reporting an accident but in such a way that the gap between W and W_A increases, making it less attractive to report accidents for a given compensation, c. Similarly, targeted EPL, which lowers δ but leaves δ_A unchanged also increases the gap between W and W_A, reducing in this way the reservation wage and accident reporting. For example legislation prohibiting dismissal in case of parental leave would be expected to have this effect. Another example of such a change in legislation, albeit in the opposite direction, is the introduction in 2013 of the Employee Shareholder Scheme in the UK, which allows firms to give new shares to employees in exchange for waiving some of the unfair dismissal rights (although not where dismissal is on health and safety grounds). In conclusion, we expect general labour market reforms that dismantle some of the EPL to reduce the expected value of future employment, increase the reservation wage, and incentivise behaviours that have immediate short term benefits, like reporting minor accidents in the hope of some form of compensation.

Figure 4 represents the reservation wage as a function of market tightness assuming that matching between unemployed workers and jobs is made according to a Cobb-Douglas matching function. In this case, the probability of finding a job has the form $q(\theta) = m_0\theta^{1-\alpha}$, where m_0 and α are positive constants and $0 < \alpha < 1$. A

[7] This particular result is dependent on the linear form suggested by Boeri and van Ours (2008). A non-linear relationship between the rate of job separation and the cost of firing could result instead in the ratio rather than the difference between δ_A and δ remaining constant. In this case an increase in the costs of firing across the board would have ambiguous effects on the reservation wage but nevertheless, the possibility that such a policy may deter workers from reporting accidents remains.

tighter labor market diminishes the threat of unemployment and therefore increases the wage above which workers refrain from reporting accidents.

Figure 4 about here.

The equilibrium wage is determined by a bargaining process between firms and workers as explained in the next section. This equilibrium wage, w^*, may be above or below the reservation wage. If $w^* < \overline{w}$, on average λ percent of employees report accidents.[8] If on the other hand $w^* > \overline{w}$, it is still the case that on average λ percent of employees suffer accidents, but none of them are reported.

2.2 THE JOB CREATION CONDITION AND THE NEGOTIATED WAGE

The equilibrium wage is determined by a search and matching model (see Mortensen and Pissarides, 1999). Vacancies are filled following a search process, which is costly for the firm, but generates profit once a match is achieved. If accident reporting takes place, the value of employing a worker (J) is determined by

$$rJ = p - w - \lambda c + \bar{\delta}(V - J), \tag{5}$$

where p is the output of the match and $\bar{\delta}$ is the average rate of separation, $\bar{\delta} = \lambda\delta_A + (1-\lambda)\delta$. Minor accidents are costly as they entail some form of compensation, but c could also be interpreted as a temporary loss of productivity for example due to sickness absence. Job separation leaves the firm with a vacancy, which is costly to fill, but holds the promise of a future match. The value of a vacancy, V, satisfies

$$rV = -a + \eta(\theta)(J - V), \tag{6}$$

where a is the search cost and $\eta(\theta)$ is the probability of filling the vacancy as a function of market tightness, $\eta'(\theta) < 0$. Once a vacancy arises the firm has a choice between advertising it again (if $V > 0$), or not (if $V < 0$). Despite the costly search, the value of a vacancy can be positive, if the probability of finding a match and the profit obtained once a match is achieved are high enough. Profit maximisation and free entry however, require that the value of a vacancy be equal to zero in equilibrium. From (5) and (6), by imposing $V = 0$ we obtain the job creation condition

$$\widetilde{w} = p - \lambda c - \frac{a(r+\bar{\delta})}{\eta(\theta)}, \quad \text{where} \qquad \frac{\partial \widetilde{w}}{\partial \theta} = \frac{a(r+\bar{\delta})\eta'(\theta)}{\eta^2(\theta)} < 0. \tag{7}$$

Free entry and exit of firms on this market ensures that wages gravitate towards this level. Wages are negotiated between workers and firms in a bargaining process from which the workers extract a share of the surplus, $W - U + J - V$, in proportion with their bargaining power, β:

[8] We rely here on the law of large numbers. If the probability of having an accident is λ and we observe the incidence of accidents over a large number of periods the share of workers having an accident converges on λ.

$$W - U = \beta(W - U + J - V). \quad (8)$$

The surplus of the worker, $W - U$, is determined by equations (1), (2) and (3), while the surplus of the firm, $J - V$, can be obtained from equation (6) by imposing $V = 0$. The resulting negotiated wage is

$$\widehat{w} = b - \lambda c + \frac{a\beta}{1-\beta}\left[\theta + \frac{(r+\delta+\lambda)(r+\delta_A)}{\eta(\theta)(r+\delta_A+\lambda)}\right], \text{ where } \frac{\partial \widehat{w}}{\partial \theta} = \frac{a\beta}{1-\beta}\left[1 - \frac{(r+\delta+\lambda)(r+\delta_A)}{r+\delta_A+\lambda}\frac{\eta'(\theta)}{\eta^2(\theta)}\right] > 0. \quad (9)$$

The job creation wage and the negotiated wage are represented together with the reservation wage in Figure 4 under the assumption of a Cobb Douglas matching function with $\eta(\theta) = \frac{m_0}{\theta^a}$. Market tightness, θ, reduces the probability of finding a worker, which reduces the value of a vacancy. The number of vacancies falls, which puts downward pressure on $\widetilde{w}$ - the job creation wage is negatively sloped. On the other hand higher θ increases the value of being unemployed because the probability of finding a job is higher. A tighter labour market therefore improves the negotiating position of the workers by giving them a better fall back option (or threat point) in case the negotiation fails to achieve a match. The opposite is true for the firm, whose fall back option V is now lower. The resulting negotiated wage is higher so $\widehat{w}$ in Figure 4 is upward sloping.

The job creation wage in (7) and the negotiated wage in (9) result in an equilibrium wage, w^*, and market tightness, θ^*. The figure shows the situation in which the equilibrium wage w^* is below the reservation wage and therefore all accidents are reported. In this equilibrium $1 - \lambda$ percent of workers have no accidents and are paid w^*, while λ percent of workers have accidents, claim compensation and get paid $w^* + c$.

Changes in exogenous variables such as the rate of job separation, productivity, the negotiation powers, the level of compensation etc. can flip the equilibrium from reporting to non-reporting and back. As equilibrium wages rise above the reporting threshold they increase as the firm and the workers internalise the absence of accident claims. The workers demand higher wages because λ percent of them are deprived of compensation, while the firms are willing to pay higher wages because they have lower costs. Above $\overline{w}$ all workers are paid the same wage and none of them request compensation.[9] A change in employment protection has an impact on all three schedules in Figure 4 through δ and δ_A.

2.3 THE EFFECT OF EMPLOYMENT PROTECTION

To find the effect of employment protection on equilibrium wages we consider first a reduction in the general level of employment protection, the kind of change that would reduce both c_f and c_{Af}, increasing δ and δ_A. Such legislation increases the

[9] In our theoretical model workers either report every accident or they do not report any. This all or nothing situation changes when we apply the model to data collected from a panel of countries. Variables such as the probability of having accidents, compensation, search costs and even negotiating powers are determined at the sectoral level within countries. Furthermore, workers in the model are identical in terms of preferences and productivity while the data may capture a great deal of heterogeneity. Any shock is expected to have a smoother effect on accident reporting, equilibrium wages and market tightness than that implied by our theoretical model.

reservation wage as implied by Section 2.1 and as a result may increase accident reporting. But there is also an effect on equilibrium wages coming from changes in the job creation condition and wage negotiation process.

A fall in the cost of firing workers has some advantages for the firm because it becomes easier to adjust to shocks that require a reduction in the number of workers (such as a negative productivity shock). With a higher rate of job separation vacancies arrive at a faster rate and the firm stops searching until the number of workers is reduced to the new optimum. In equilibrium though, higher turnover is costly so the job creation wage, $\widetilde{w}$, is lower. On the other hand a higher rate of job separation reduces the expected value of a job for the workers who in turn require higher wages, $\widehat{w}$, to accept a job offer. Figure 5 represents graphically the effect of such an increase in the rate of job separation for the reservation wage, the job creation wage and the negotiated wage. The labour market is less tight in equilibrium but the effect on equilibrium wages is likely to be small.

Figure 5 about here

Turning now to a reduction in employment protection only for accident reporting workers, which reduces c_{Af} and increases δ_A, leaving δ unchanged, such change in legislation *reduces* the reservation wage $\overline{w}$ as implied by Section 2.1. This specific change in legislation however, has the same effects on the job creation condition and the negotiated wage as the wider ranging reform described in the previous paragraph and captured by Figure 5. From the point of view of a firm that already faces compensation claims, an increase in δ_A increases turnover and reduces the job creation wage, $\widetilde{w}$, which shifts down as in Figure 5, but the shift is somewhat smaller because only λ percent of workers are affected. The effect of such a measure on the negotiated wage is also in the same direction to that shown in Figure 5. As workers push for higher wages in response to lower job security, $\widehat{w}$ shifts up, albeit by less because only a fraction of workers are affected by the increase in δ_A. With lower reservation wages and a stable equilibrium wage, reporting may flip into non-reporting in this situation.

In conclusion, whether labour market reforms increase the job separation rate only for workers who report accidents or for everyone, the equilibrium wage remains relatively stable, while market tightness is reduced. However the type of reform matters for the reservation wage, above which workers refrain from reporting accidents. As the equilibrium wage is relatively stable the effect of reforms on the reservation wage is crucial in determining whether workers report accidents or not. In the case of narrow reforms, which increase the rate of separation only for accident reporting workers, the reservation wage falls, which should reduce accident reporting if the reservation wage moves below the equilibrium wage. In the case of wider ranging reforms, which increase the rate of job separation for all workers regardless of whether they report accidents or not, the effect on the reservation wage is in the opposite direction – an increase. The effect may be an increase in reporting if the reservation wage shifts above the equilibrium level.

The index of employment protection used in our empirical analysis covers a wide range of measures, from notification procedures to reinstatement in case of unfair dismissal and is not specific about the causes of dismissal. Dismantling such legislation is likely to lower the costs of firing irrespective of the reasons that lead to this. In cases where labour market reforms are focused on weakening protection for accident reporting the theoretical results indeed point in the direction of less reporting taking place because workers are afraid of dismissal. But where reforms are wide ranging it is possible that reporting is increased due to the general reduction in job security, which makes the accident compensation relatively more attractive for workers who experience accidents.

2.4 OTHER IMPLICATIONS

Our theoretical framework has implications for the relationship between other variables and the number of accidents reported.

The compensation level, c, and the probability of having an accident, λ, both raise the reservation wage $\overline{w}$, making it more attractive for workers to report accidents. Higher compensation also reduces equilibrium wages as firms adjust to compensation claims by reducing the wage they pay. Higher probability of having an accident raises the temptation to claim because the frequency with which compensation is paid depends on the frequency of accidents. Firms however take this into account when they decide to open a vacancy and negotiate the wage with the workers. The equilibrium wages are likely to be pushed down as a result. [10]

The negotiating power of the workers relative to the firm, β, determines the outcome of wage bargaining. With higher negotiating power workers are able to push the negotiated wage, $\widehat{w}$, higher and therefore achieve a higher equilibrium wage. Starting from a reporting situation the boost in wages may be enough to push equilibrium wages above the reservation wage and stop accident reporting. In a world where negotiating power has this narrow effect we would expect to see a reduction in reporting when workers' power increases. However, workers' negotiating power is often achieved through trade unions, which may have additional effects on the behaviour of firms and workers. For example the existence of a trade union may reduce the probability of having accidents by raising health and safety standards. Trade unions may also increase the costs of firing.

Higher unemployment benefit, b, should increase accident reporting because it reduces the penalty associated with being unemployed ($\overline{w}$ shifts up one for one with an increase in b in Figure 4). But a higher unemployment benefit also raises equilibrium wages, making it less attractive to report ($\widehat{w}$ also shifts up one for one with

[10] The effect on the negotiated wage in equation (9) is somewhat more complicated as it also depends on the penalty for reporting (the gap between δ_A and δ): $\frac{\partial \widehat{w}}{\partial \lambda} = -c + \frac{a\beta}{1-\beta}\frac{r+\delta_A}{\eta(\theta)}\frac{\delta_A-\delta}{(r+\delta_A+\lambda)^2}$. The ambiguity appears because a high penalty deters reporting – so a higher proportion of workers may suffer accidents, which reduces the negotiated wage, but few report them, which cushions the effect. The effect on the job creation wage in equation (7) is unambiguously negative though.

b). The result is lower market tightness and higher unemployment but it is not clear whether any change occurs in reporting behaviour. We expect the unemployment benefit to have little if any effect on accident reporting.

Higher productivity, p, increases the job creation wage, putting upward pressure on equilibrium wages. As the reservation wage is not directly affected, higher productivity should reduce reporting if the equilibrium wage moves above the reservation wage.

3 DATA AND ECONOMETRIC RESULTS

Following the theoretical model developed in the previous section, we estimate equations for the rate of workplace accidents – both non-fatal and fatal – focusing on the impact of employment protection legislation. The data used for this empirical analysis comes from the ILO Bureau of Statistics (LABORSTA) and focuses on 16 countries in the OECD from 1985 until 2011.[11] The Resolution concerning statistics of occupational injuries (resulting from occupational accidents) adopted by the 16th International Conference of Labour Statisticians (Geneva 1998) defines an occupational injury to be any personal injury, disease or death resulting from an occupational accident. An occupational injury is therefore distinct from an occupational disease, which is a disease contracted as a result of an exposure over a period of time to risk factors arising from work activity. Data on occupational injuries are most frequently obtained from occupational accident reporting systems (e.g. to a labour inspectorate) or occupational injury compensation schemes. The type of source determines the coverage of the statistics. In many countries, the coverage of the statistics is limited to certain types of workers, usually employees only.

Our set of control variables includes the unemployment rate and GDP growth rate to control for the effects of the business cycle. A negative sign on unemployment is expected if higher unemployment reduces the probability of finding a job and makes workers more cautious in reporting workplace accidents. Unemployment also captures the effect of labour market shocks that have an impact on equilibrium wages. GDP growth captures productivity shocks. As productivity drives equilibrium wages up in economic booms we should observe less accident reporting. But there is also evidence that expansion periods see an increase in new hires and work intensity as well as work stress, all of which can lead to a higher probability of having accidents (Davies *et al*. 2009; Palali and van Ours, 2017).

We also add the log of trade union density and the unemployment benefit replacement ratio. Trade union density is included to control for workers' bargaining power, which tends to raise equilibrium wages and reduce reporting. Apart from this,

[11] The countries analysed are Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, Switzerland, UK and US.

trade unions may also improve health and safety at work, reducing the number of accidents that occur.[12]

Some sectors, such as mining, agriculture, construction and transport have a higher accident probability compared to other sectors, in which most workers are office-based (Boone and van Ours, 2006, show accident rates by industry). Differences in industrial structure across countries and over time could therefore explain differences in accident rates. We add country-specific time trends to capture these effects. In addition, these country trends may also capture differential improvements in health and safety at work across countries and differences in data collection. Finally, dummy variables are introduced where there are changes in the definition of the dependent variable. These are usually due to changes in the revision of the International Standard of Industrial Classification (ISIC) used by the ISO in compiling these statistics (see Table A.1 in the Appendix for further details).

3.1 Econometric Results

We begin by looking at the determinants of the rate of non-fatal accidents in the workplace. The first column of Table 2 shows a simple regression that features as its explanatory variables the log of the rate of unemployment (ln *UR*), GDP growth (*GDP-GR*) and an indicator based on the OECD measure of the strictness of employment protection legislation for regular contracts (*EPL*). The results suggest that an increase of 10% in the unemployment rate leads to a 5.6% drop in the rate of non-fatal accidents, while the coefficient on GDP growth is insignificant. Importantly, the coefficient on *EPL* is significant at 5%, indicating that higher employment protection for regular contracts results in less reporting of accidents.

Table 2 about here

Our next step is to introduce two additional control variables into the equation, trade union density (ln *DEN*) and the replacement ratio (*RR*). The results are presented in column (2). The coefficient on *EPL* remains significant, but the log of trade union density fails to achieve significance, a finding that is repeated throughout this table. However, the log of the replacement ratio is significant, suggesting that an increase in the replacement ratio for unemployment benefits has a positive effect on the rate of non-fatal accidents. This is to be expected, as workers are less afraid of unemployment, but the coefficient is very small. An increase in unemployment benefit of one percentage point increases the rate of non-fatal accidents by only 0.003%. We surmise that this is due to the increase in equilibrium wages, which acts as a deterrent for accident reporting.

[12] Related to this, Bryson (2016) notes that trade unions in Britain have a strong influence on the policy and practice of health and safety legislation. According to Bryson (2016) the Health and Safety Executive Board and its predecessor, the Health and Safety Commission, have a tripartite tradition, with appointments being made from the ranks of employers, trade unions and independent experts drawn from academia and industry.

There is some concern about the identification of results presented in columns (1) and (2). A causal link between *EPL* and workplace accidents cannot be established using OLS if *EPL* is endogenous. Although these results are obtained from within-country time variation in regressions with country fixed effects, unobserved country-specific shocks may generate unobserved correlation, making any causal claim impossible. Additionally, reverse causation may be at work at the country level, as employment protection regulation may be driven by the need to protect workers who report accidents. Unemployment and the rate of growth may also be affected by endogeneity because any reporting behaviour has an impact on hiring and firing of workers.[13] Columns (3) and (4) repeat the earlier estimations but use two stage least squares (2SLS) employing the one-year lag of the explanatory variables as instruments to control for endogeneity.[14]

The results are similar for most variables, except that the coefficient on *EPL* becomes larger in absolute terms. Least squares estimations suggest a reduction in *EPL* of one unit increases reporting by 17-19%, while 2SLS estimates suggest a much bigger increase, of 30-33%. In reality countries generally undertake reforms in small steps so that changes in *EPL* from one year to another tend to be smaller than one. It is more informative to look at the effect of the change in *EPL* over the whole period. Based on the reduction in cross country mean *EPL* between 1985 and 2011 and using the coefficients in Table 2, we conclude that the fall in employment protection for regular workers is associated with an increase of about 3.5-6.5% in *NFA*.[15]

Our results so far suggest two possibilities, which are not mutually exclusive: *EPL* has an effect on the true rate of accidents, or *EPL* has an effect on the willingness to report accidents. To find out whether *EPL* influences incentives it is helpful to analyse the rate of fatal accidents. Fatal accidents tend to be reported more accurately than non-fatal accidents and therefore the willingness to report should play a smaller role. If incentive effects are strong we would not expect to see a correlation with *EPL* when we look at the rate of fatal accidents (Boone and van Ours 2006 and Davies, Jones and Nunez 2009 also make this distinction when studying the cyclicality of workplace accidents). If cyclical variations in accident reporting are

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[13] Unemployment in our theoretical model is endogenous. In equilibrium the flows into unemployment should equal the flows out of unemployment, therefore $(1-u^*)\times\bar{\delta} = u^* \times q(\theta^*)$, which results in an equilibrium rate of unemployment $u^* = \frac{\bar{\delta}}{\bar{\delta}+q(\theta^*)}$. A higher rate of job separation induced by labour market reforms reduces market tightness as in Figure 5 and increases equilibrium unemployment. This is the case regardless of whether reporting of accidents takes place and regardless of whether reforms touch only δ_A or both δ_A and δ. Indeed, any other shock that has effects on market tightness will affect both the rate of unemployment and accident reporting.

[14] The instruments used are the first lags of the right hand side variables, all the dummies and trends. We report the F-statistic for the excluded instruments from the first stage regression of *EPL* on the instruments (the F-statistics for the first stage regressions of the other variables on the right hand side are not reported but the null of no correlation is rejected in all cases). We also report the Kleiberger-Paap (2006) under-identification test statistic, which is recommended when the system is just-identified and robust standard errors are calculated.

[15] The calculations here are based on the change in cross country mean *EPL* index between 1985 and 2011, which takes the value Δ*EPL*= -0.22 units. The percentage change in *NFA* is calculated as $e^{\alpha\times\Delta EPL}-1$, where α is the coefficient on *EPL* from Table 2. The range of results varies from 3.5% increase in NFA in column (2) to 6.5% in column (3).

also due to incentives rather than changes in the true rate of accidents, unemployment should also appear as insignificant, as suggested by Boone and van Ours (2006). On the other hand the rate of GDP growth may be positively related to the rate of fatal accidents as the effect of cyclical work stress occurs for non-fatal as well as fatal accidents (see Palali and van Ours 2017). The estimates in Table 3, which repeats the regressions estimated for the rate of non-fatal accidents, for the most part tend to support this. The coefficients on both the log of the unemployment rate and the index of *EPL* appear to be mostly insignificant throughout this table. We do not find any evidence of an increase in fatal accidents during booms.[16]

Table 3 about here

The effects of trade union density are more difficult to explain. It appears that higher trade union density is associated with a higher rate of fatal accidents. This result does not hold for non-fatal accidents – trade union density has no significant effect in Table 2. There is little evidence on the effect of trade unions on work accidents. Trade unions tend to increase wages and therefore reduce the incentives to report accidents for a given unemployment level. They also claim to reduce accidents by involving workers in health and safety decisions. While these factors indicate that the correlation between trade union density and accidents reported should be negative, trade unions also strive to improve the reporting of accidents. The ambiguity of the correlation is compounded by the possibility that union membership may be more attractive in riskier industries. Fenn and Ashby (2004), using UK data also find a positive effect of trade union membership on serious injuries (including fatal). They suggest this result is likely to be due to the involvement of trade unions in ensuring full disclosure of accidents. In addition, it is worth noting that Bryson (2016) finds that an increase in trade union density leads to a higher perceived level of risk in the workplace.

In conclusion, our results so far indicate that the effect of EPL on workplace accidents is due to changes in reporting behaviour rather than changes in workplace safety. Conventional wisdom suggests that reducing the degree of employment protection should lead to less reporting of accidents as workers fear dismissal. However, the model in Section 2 suggests that wide ranging reforms to the labour market, which make it easier to fire workers for any reason could have the opposite effect on accident reporting. By reducing the expected value derived from employment, a higher probability of dismissal may increase accident reporting. The fall in our measure of employment protection over time captures broad labour market reforms undertaken by most countries and in all areas of labour market regulation.

[16] It is likely that the lack of significance of our GDP growth variable throughout the regressions is explained by our use of country trends and year dummies. Palali and van Ours (2017) find a significant effect for GDP growth on fatal accidents when they omit country trends and year dummies. When both of these are added the coefficient on GDP growth turns negative and becomes insignificant as it does in our Table 3.

3.2 Further Analysis

The evidence that we have gathered so far suggests that labour market reforms aimed at reducing employment protection have increased the reporting of non-fatal accidents. To investigate this result a little further we first divide the employment protection index into its subcomponents (*EPL1*, *EPL2* and *EPL3* as identified in Figure 2) to find the effect of different types of legislation on non-fatal accidents.

Table 4 reports the results of further 2SLS regressions in which the dependent variable is the log of the rate of non-fatal accidents. Columns (1) to (4) use the components of *EPL* as regressors. It appears that results for *EPL* are mainly driven by a reduction in the notification and delay procedures as encapsulated by *EPL2,* although *EPL1* is also significant at 5% when introduced in the regression on its own. *EPL3* is only marginally significant in column (4), also with a negative sign. The results continue to indicate that the rate of non-fatal accidents is negatively related to the log of the unemployment rate and positively related to the unemployment benefit replacement ratio.

Table 4 about here

We also check that our results hold when temporary contracts are taken in to consideration because countries with strict employment protection for regular contracts sometimes allow the widespread use of temporary contracts to introduce flexibility on the labour markets (see Palali and van Ours 2017, who study the importance of temporary contracts for Italy and Spain). Several papers investigate differences in accident rates between temporary and permanent workers (Virtanen *et al.* 2005, provide a review of the evidence) although they fail to draw a clear conclusion on whether temporary work increases the risk of accidents. There is some evidence that temporary workers have a higher risk of occupational injury, which can be attributed to their lack of experience on the job. Against this, Davies *et al*. (2009) find that at the sectoral level the rate of minor injuries is negatively related to the share of temporary workers, whilst the rate of major accidents is independent of this share.

To see whether temporary contracts change our conclusion about the effect of employment protection, we add two variables to our estimations, *Temp1*, which is the OECD index quantifying the restrictions placed on the use of temporary contracts, and *Temp2*, which is the share of temporary workers (both of these are represented in Figure 3). The regression results are shown in columns (5) and (6) of Table 4. It is apparent that these two variables are not significant and they do not affect the coefficient for *EPL*, which has about the same magnitude and significance as in Table 2. The conclusion is that once we control for unemployment, which constitutes a clear deterrent for accident reporting, employment protection reduces the incentives of workers to report workplace accidents. This negative correlation is present no matter what component of employment protection

legislation we consider and after controlling for the presence of temporary contracts.[17]

4 CONCLUSIONS

This paper investigates the effect of employment protection legislation on workplace accidents. Overall the trend in most countries in the sample is towards reducing all aspects of labour market regulation. Over the same period the incidence of non-fatal and fatal accidents decreased. We investigate whether there is a correlation between these two trends, in particular whether lower employment protection contributes to the downward trend in accident reporting by reducing the incentives of workers to report workplace accidents.

Our theoretical analysis suggests that making it easier for firms to fire workers who report accidents indeed has the effect of reducing such reporting. On the other hand wide ranging labour market reforms, which make it easier for employers to dismiss employees for a range of reasons, may reduce the expected value of future employment and in turn incentivise workers to report accidents. Our empirical analysis supports the latter conjecture: rather than contributing to the downward trend in accident reporting, labour market reforms appear to have slowed it down. We provide evidence that the reduction in a broad measure of employment protection regulation in our sample of countries is associated with an increase in the rate of non-fatal accidents. This effect is not present for fatal accidents, suggesting that the effects we identify are due to variations in the willingness of workers to report accidents rather than to changes in workplace safety.

Further investigation focused on the components of employment protection legislation reveals that reductions in the length of notice period and amount of severance pay offered to dismissed employees tend to stimulate the reporting of non-fatal accidents. Furthermore, results do not change when we account for the concomitant spread of temporary contracts, which is another consequence of labour market reforms.

The paper suggests that the unemployment rate is a strong deterrent for accident reporting, supporting the evidence first provided by Boone and van Ours (2006). A 10% increase in the rate of unemployment produces, on average, a decrease in the rate of non-fatal accidents of about 5-6%. This would suggest that recessions are good for workplace safety, but since the result does not extend to fatal accidents we must conclude that the cyclical fluctuations in the rate of non-fatal accidents are due to changes in the willingness to report rather than the actual rate of accidents.

[17] We added an interaction term between *EPL* and *Temp2*, but it turned out to be insignificant. We also checked the robustness of the results by taking out Canada, Switzerland and the US, for which there is no variation in *EPL*. The results are little changed. Finally, we omitted Portugal and Spain, which have a lot of variation in *EPL* and the results remain strong for *EPL2*, but are somewhat weaker for the aggregate *EPL*. While omitting Portugal makes little difference, Spain has a stronger influence on our results. Without Spain *EPL2* is strongly significant and negative but *EPL1* also becomes significant and positive.

We also find that the rate of non-fatal workplace accidents is an increasing function of the unemployment benefit replacement ratio, but the effect is very small. On one hand workers become less afraid of losing their job, so they are more likely to do things that increase their probability of dismissal, such as making accident claims at work. But on the other hand workers are paid more, which increases the value they place on keeping their job and this dampens the positive effect. Finally the number of fatal accidents at work is increasing in trade union density, which may be due to better disclosure of accidents although it is not clear why this effect does not extend to non-fatal accidents as well.

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DATA APPENDIX

The data on workplace accidents is collected from the ILO Bureau of statistics LABORSTA database, which is available from http://laborsta.ilo.org/. The sources of information by country are published below in Table A.1.

Table A.1

	Source[a]	Subject[b]	Minimum period (days)	Period	Breaks[c]
Belgium[d]	FA	82	1	1984-2012	s93-97, s98-04
Canada	FA	82	1	1985-2011	
Denmark	FF	81	1	1978-2011	s91-01
Finland	FA	82	3	1978-2011	s93-07
France	FA	82	1	1975-2010	
Germany[e]	FA	82	4	1990-2011	
Greece	FA	82	1	1979-2003	s82-03
Ireland	FF	81	4	1976-2011	s90-07
Italy	FA	82	4	1979-2011	s91-08
Netherlands	FA/WC	81	1	1976-2012	s11-12
Portugal	FA	81	1	1979-2007	s89-07
Spain[e]	FA	81	1	1980-2012	s88-08
Sweden	FA	81	1	1979-2012	d94
Switzerland	FA	82	1	1984-2011	
United Kingdom	FF	81	3	1986-2011	d98
United States	DA	81	1	1976-2012	

[a] ILO classification. Source: FA= insurance records, WC = Working Conditions Survey; FF = labour inspectorate records, DA= labour related establishment survey.

[b] Subject: 81 = reported, 82 = compensated.

[c] Breaks in series as accounted for in the empirical analysis; s = shift concerning a time period; d = dummy variable for a particular year.

[d] Including commuting accidents.

[e] Fatal accidents: deaths occurring within 1 month of accident.

Other variables

Unemployment rates

Harmonised unemployment rates as percentage of active population are from the OECD Labour Force Statistics, accessed at http://www.oecd-ilibrary.org/economics/harmonised-unemployment-rates_2074384x-table6.

Employment protection legislation and the incidence of temporary work

We use the summary indicator of the strictness of *EPL* compiled by the OECD, which varies between 0 and 6. *EPL* refers to the rules affecting regular (permanent) workers dismissed on personal grounds or economic redundancy, but without fault (unweighted average of *EPL1*, *EPL2* and *EPL3*):

EPL1 quantifies procedural inconvenience (notification procedures and number of days of delay before notice can start);

EPL2 covers the number of months of notice required and amount of severance pay (in number of months pay) for no-fault individual dismissal;

EPL3 quantifies the difficulty of dismissal (the definition of justified / unfair dismissal, length of trial period in months, typical compensation following unfair dismissal after 20 years of tenure in months pay and possibility of reinstatement following unfair dismissal);

Temp1 refers to rules affecting standard fixed-terms contracts and temporary-work-agency employment. It quantifies the circumstances in which temporary contracts are allowed, and the maximum number and cumulated duration of these contracts.

Details of the methods used to construct values of the employment protection indicators may be found in Venn (2009, Annex A, p. 39). The data are obtainable from the following link:

http://www.oecd.org/employment/employmentpoliciesanddata/oecdindicatorsofemploymentprotection.htm.

Temp2 is the share of temporary employment. Temporary employment includes wage and salary workers whose job has a pre-determined termination date. It is measured as a percentage of dependent employees – i.e. wage and salary workers. Figures can be obtained from the OECD, at: http://stats.oecd.org/Index.aspx?DataSetCode=TEMP_I#

Civilian Employment and Trade Union Density

Trade union density is calculated as the ratio of the number of wage and salary earners that are trade union members, divided by the total number of wage and salary earners. Figures are obtainable from the Online OECD Employment Database at:

http://www.oecd.org/els/emp/onlineoecdemploymentdatabase.htm.

Unemployment Benefit (Gross Replacement Rates)

Gross replacement rates express gross unemployment benefits as a percentage of previous gross earnings. OECD figures are obtainable from http://www.oecd.org/els/benefits-and-wages-statistics.htm. These figures are only available bi-annually and therefore it is necessary to interpolate the missing data.

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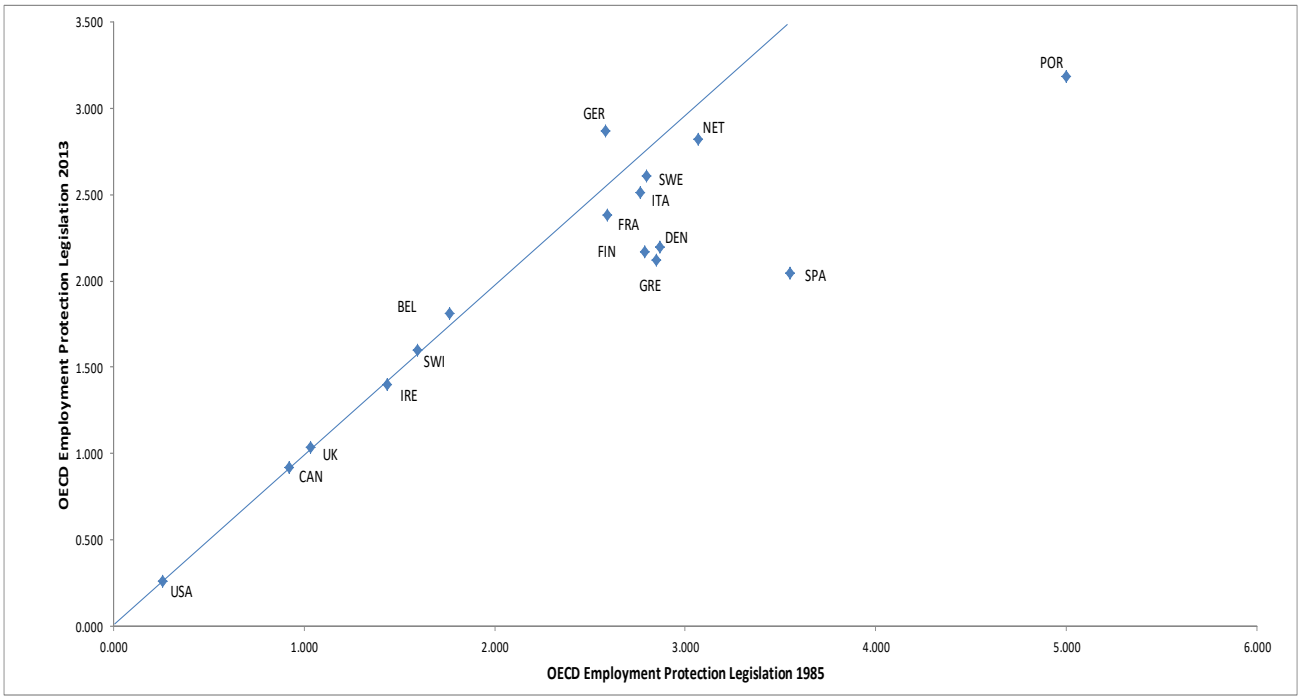
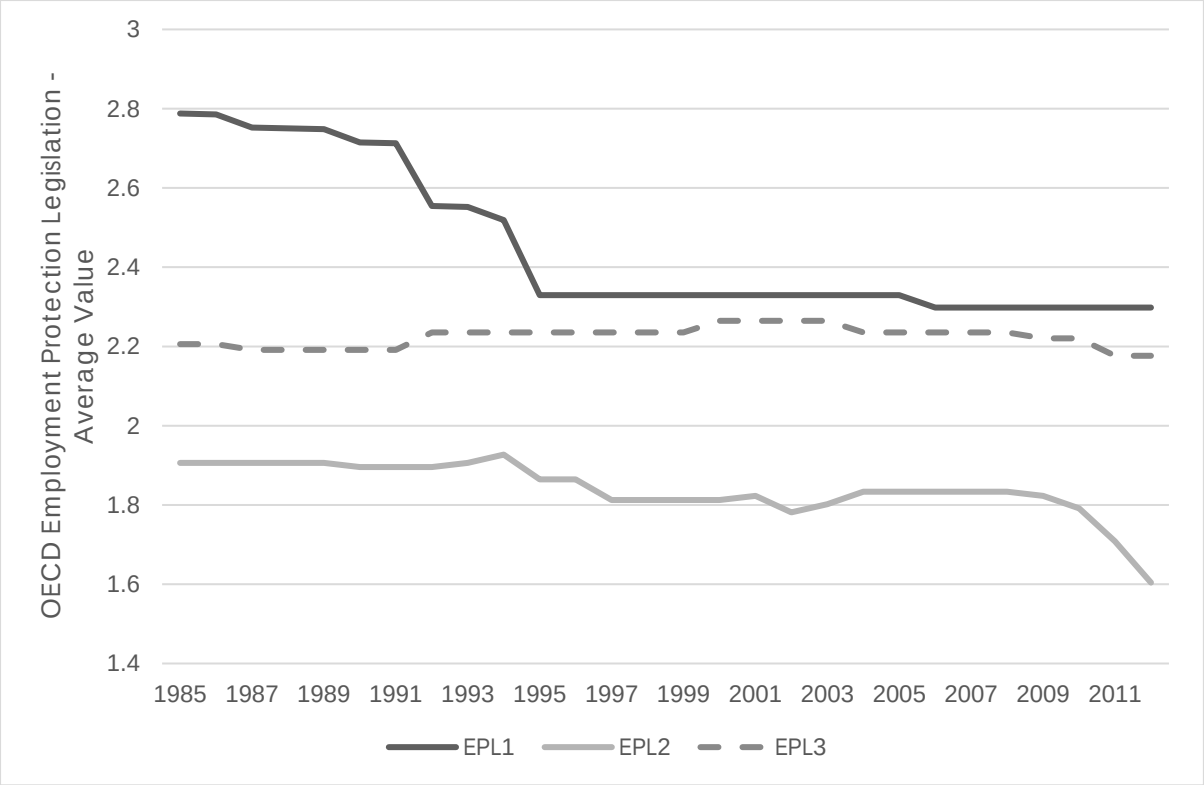
***Figure 1*. OECD Indicator of EPL, 1985 and 2013.**



Source: Authors' own calculations using data from OECD.

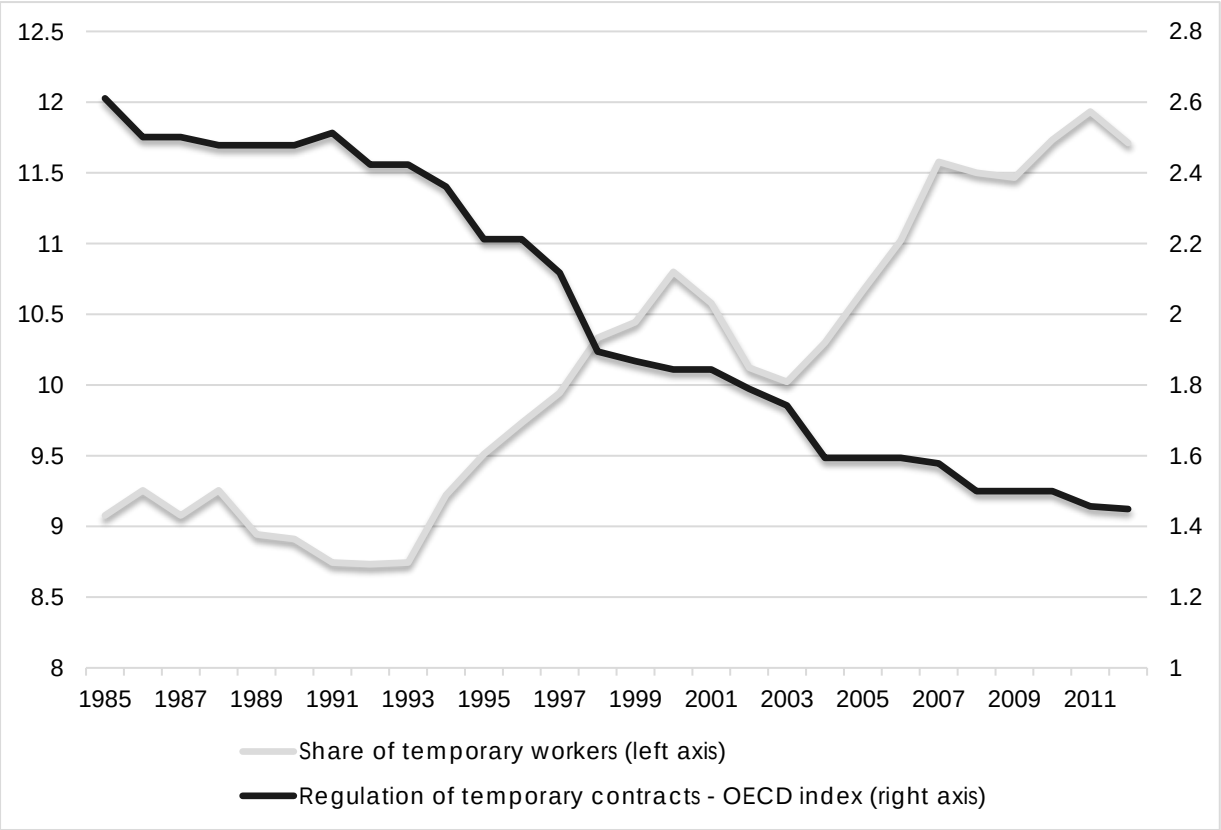
Figure 2. **Summary Indicators of OECD Employment Protection Legislation for Regular Contracts**



Note: Mean value of the indicator of employment protection legislation for the 15 countries in our sample for the following variables: *EPL1* = OECD employment protection measure for notification procedures and the delay involved before notice can start; *EPL2* = OECD employment protection measure for length of notice period and severance pay to employees dismissed by the employer; *EPL3* = OECD employment protection measure for unfair dismissals.

Source: OECD Indicators of Employment Protection.

***Figure 3*. The Share of Temporary Employment and Regulation of Temporary Contracts**



Note: The data are cross-country yearly average values. The share of temporary workers is missing for some countries in the early years – the graph is based on the data available each year (minimum 9 countries). The regulation of temporary workers measures the strictness of regulation on the use of fixed-term and temporary work agency contracts.

Source: OECD Employment Database and OECD indicators of Employment Protection.

Figure 4. Equilibrium on the labour market with accident reporting.

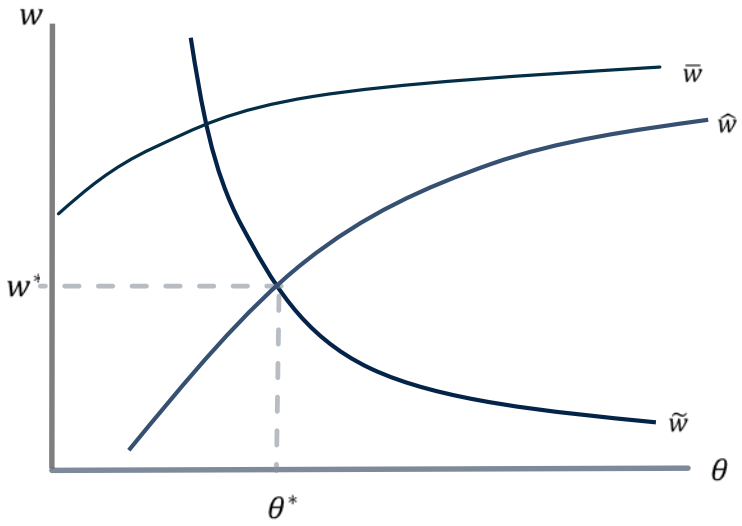


Figure 5. The effect of labour market reforms.

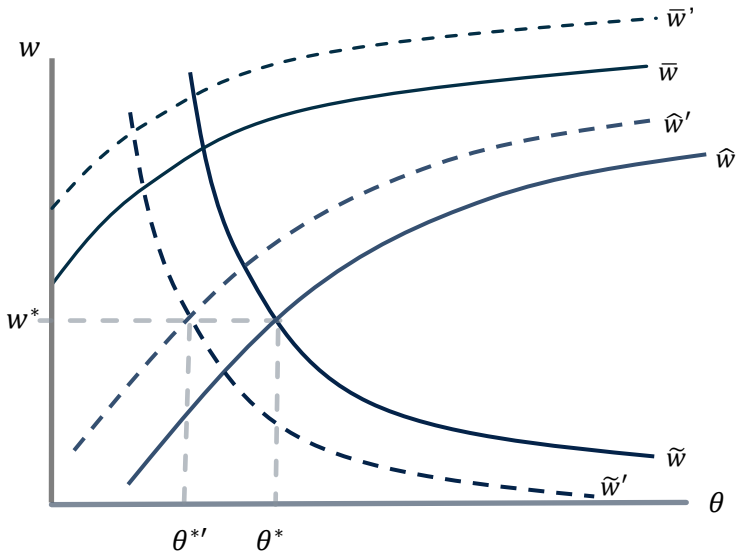


***Table 1*. Number and Rate of Workplace Accidents 1990 and 2011 (percentage of civilian employment)**

Country	1990[a]				2011[b]			
	Fatal accidents		Non-fatal accidents		Fatal accidents		Non-fatal accidents	
	Number	0.01%	Number ('000)	%	Number	0.01%	Number ('000)	%
Belgium	106	0.3	115	3.0	82	0.2	85	1.9
Canada	943	0.7	594	4.5	361	0.2	216	1.2
Denmark	71	0.3	45	1.7	40	0.1	42	1.5
Finland	74	0.3	103	4.1	26	0.1	51	2.1
France	1213	0.5	760	3.2	529	0.2	659	2.6
Germany	1558	0.4	1670	4.6	664	0.2	1007	2.5
Greece	84	0.2	28	0.7	107	0.3	15	0.4
Ireland	49	0.4	31	0.3	49	0.3	79	0.4
Italy	1423	0.7	922	4.3	621	0.3	403	1.8
Netherlands	59	0.1	656	1.0	49	0.1	908	10.8
Portugal	203	0.5	305	6.8	276	0.5	174	3.4
Spain	1446	1.1	695	5.4	335	0.2	511	2.9
Sweden	117	0.3	87	1.9	58	0.1	28	0.6
Switzerland	182	0.5	146	3.8	129	0.4	94	2.0
United Kingdom	359	0.1	184	0.7	171	0.1	171	0.4
United States	2900	0.2	3124	2.6	4693	0.3	1181	0.8
Total	10789	0.3	9465	2.7	8190	0.3	5624	1.5

***Table 2*. Econometric Analysis: Non-Fatal Accident Rates (ln *NFA*)**

Explanatory variables	(1)	(2)	(3)	(4)
Constant	4.289***	4.333***	4.588***	5.088***
	(24.49)	(9.96)	(18.44)	(9.44)
ln *UR*	-0.559***	-0.557***	-0.574***	-0.551***
	(8.32)	(8.50)	(7.25)	(7.76)
GDP-GR	0.007	0.008*	0.006	0.010
	(1.51)	(1.66)	(0.65)	(1.025)
EPL	-0.170**	-0.158**	-0.287***	-0.267**
	(2.53)	(2.28)	(2.67)	(2.47)
ln *DEN*		-0.025		-0.162
		(0.25)		(0.17)
RR		0.003**		0.004*
		(2.02)		(1.93)
$\overline{R}^2$	0.985	0.988	0.989	0.989
LL	375.27	377.12		
F-stat. of excluded instruments			88.41***	56.76***
K-P rk LM stat, $\chi^2(1)$			19.35***	18.55***
Number of observations	370	370	354	354
Estimation Method	LS	LS	2SLS	2SLS

Notes: Each equation contains fixed effects for countries and calendar years, country-specific time trends and dummy variables for structural breaks (see the Data Appendix for more details). The variables are: ***NFA*** = the rate of non-fatal accidents; ***UR*** = the unemployment rate; ***GDP-GR*** = the rate of growth of real GDP; ***EPL*** = OECD employment protection measure concerned with individual dismissals for employees on regular contracts; ***DEN*** = trade union density; ***RR*** = the replacement rate for unemployment benefits. Absolute t-ratios in parentheses. *** (**) (*) denotes significance at the 1% (5%) (10%) level on a two-tailed test. ***LL*** = log likelihood. ***F-stat. of excluded instruments*** = F-statistic from the first stage regression of *EPL* on the instruments. ***K-P rk LM stat.*** = Under-identification test, Kleibergen-Paap rk LM statistic. Estimation method used: LS = least squares; 2SLS = two stage least squares estimation using the first lags of all the right hand side variables, all dummy variables and country trends as instruments.

***Table 3*. Econometric Analysis: Fatal Accident Rates (ln *FA*)**

Explanatory variables	(1)	(2)	(3)	(4)
Constant	-0.130***	-3.864***	-0.990**	-4.367**
	(4.21)	(3.58)	(2.49)	(3.05)
ln *UR*	-0.105	-0.207	-0.085	-0.238
	(0.62)	(1.38)	(0.41)	(1.31)
GDP-GR	-0.001	-0.003	0.004	-0.002
	(0.08)	(0.29)	(0.18)	(0.08)
EPL	-0.049	-0.051	-0.170	-0.190
	(0.49)	(0.53)	(1.22)	(1.32)
ln *DEN*		0.741***		0.994***
		(2.89)		(2.72)
RR		-0.0004		-0.0008
		(0.17)		(0.02)
$\overline{R}^2$	0.909	0.911	0.918	0.921
LL	112.56	118.56		
F-stat. of excluded instruments			98.44***	62.31***
K-P rk LM stat, $\chi^2(1)$			28.38***	24.89***
N	389	389	372	372
Estimation Method	LS	LS	2SLS	2SLS

Notes: Each equation contains fixed effects for countries and calendar years, country-specific time trends and dummy variables for structural breaks. ***FA*** = the rate of fatal accidents. The instruments and tests are the same as in Table 2. See the notes to Table 2 for further details.

***Table 4*. Further Analysis (ln *NFA*) – Two-Stage Least Squares Estimation**

Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
Constant	5.599***	4.633***	5.205***	4.748***	4.845***	4.944***
	(11.41)	(8.55)	(9.55)	(9.04)	(8.45)	(7.15)
ln *UR*	-0.541***	-0.563***	-0.553***	-0.579***	-0.531***	-0.437***
	(6.11)	(8.36)	(6.19)	(5.99)	(7.86)	(3.33)
GDP-GR	0.001	0.013	0.001	0.0002	0.012	0.016
	(0.08)	(1.23)	(0.11)	(0.02)	(1.22)	(0.65)
EPL					-0.254**	-0.271**
					(2.55)	(2.33)
EPL1	-0.052	-0.080**				
	(1.01)	(2.08)				
EPL2	-0.243**		-0.363***			
	(2.40)		(3.40)			
EPL3	-0.213			-0.274*		
	(1.24)			(1.83)		
Temp1					0.040	
					(1.08)	
Temp2						0.133
						(1.38)
ln *DEN*	-0.178	-0.141	-0.179	-0.056	-0.031	-0.227
	(1.23)	(0.95)	(1.18)	(0.32)	(0.79)	(1.30)
RR	0.003*	0.004**	0.004**	0.005***	0.004**	0.001
	(1.93)	(2.02)	(1.97)	(2.75)	(1.97)	(0.96)
$\overline{R}^2$	0.985	0.986	0.985	0.985	0.986	0.991
N	354	354	354	354	354	282
F-stat. of excluded instruments	*EPL1* 38.35*** *EPL2* 24.96*** *EPL3* 12.81***	*EPL1* 53.17***	*EPL2* 34.90***	*EPL3* 16.53***	*EPL* 47.32***	*EPL* 35.43***
K-P rk LM stat, $\chi^2(1)$	18.87***	19.28***	17.17***	20.71***	17.67***	5.20**
Estimation Method	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS

The additional variables are: ***EPL1*** = OECD employment protection measure for notification procedures and the delay involved before notice can start; ***EPL2*** = OECD employment protection measure for length of notice period and severance pay to employees dismissed by the employer; ***EPL3*** = OECD employment protection measure for unfair dismissals. ***Temp1*** = OECD measure of the strictness of regulation affecting the use of temporary contracts; ***Temp2*** = the log of the proportion of employees on temporary contacts. See Table 2 for further notes.